DFMA02 - FM-MC4

HARDWARE USER'S MANUAL

FM-MC4
FM FIELDSTRENGTH MEASUREMENT RECEIVER

DFMA02
DYNAMIC FM MODULATER ANALYSER

Document reference

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CERTIFICATE OF CONFORMITY

Established following the EMC 89/336/EEC and 73/23/EEC Directive

CE

98/11/18

We, hereby, certify that the **AUDEMAT-AZTEC FM_MC4 – DFMA02**, equipment complies with the dispositions of the European Community Directive concerning the rapprochement of the legislation of the State Members related to electromagnetic compatibility (EMC 89/336/EEC Directive) and to low voltage (73/23/EEC Directive).

This declaration of conformity results from respecting EMC and low voltage requirements and from an analysis carried out by AUDEMAT-AZTEC's Quality Department, complying with European standards EN 50081-1, EN 50082-1 and EN 60215.

C.E.O.

Daniel WERBROUCK

RADIO AND TELEVISION INTERFERENCE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures :

- **Reorient or relocate the receiving antenna.**
- **Increase the separation between the equipment and the receiver.**
- **Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
- **Consult the dealer or an experienced radio/TV technician for help.**

You may also find helpful the following booklet, prepared by the FCC: "How to Identify and Resolve Radio-TV Interference Problems.". This booklet is available from the U.S. Government Printing Office, Washington D.C. 20402.

Changes and Modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commissions rules.

*** In order to maintain compliance with FCC regulations shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio & television reception.**

CANADIAN MANUAL STATEMENT

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe B prescrites dans le Règlement sur le brouillage radioélectrique édicte par le ministère des Communications du Canada.

SECURITY INSTRUCTIONS

In order to preserve the security of AUDEMAT-AZTEC's equipment: FM-MC4 and DFMA02 and to ensure operating free from any danger, the User must respect the following instructions, symbols and precautions :

1 - The equipment may only be operated in the conditions described in the present manual.

2 - It is very essential to avoid any obstruction to ventilation.

3 - The equipment must only be connected to a power supply which is protected by fuses of 16A maximum.

4 - The equipment must only be operated on a grounded plug.

5 - So as not to expose the User to risk of electrocution, the protection conductor must never be unintentionally cut.

6 - Before turning on the equipment, ensure that the nominal voltage specified on the equipment corresponds to the mains nominal voltage.

7 - Before carrying out any operation on the equipment or opening it, it is necessary to unplug it from the mains.

8 - All maintenance or repair setting must be carried out by qualified person.

9 - Any maintenance adjusting or repairs must be carried out by qualified staff.

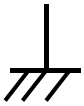
10 - All safety parts (switch or mains transformer, fuses, etc…) must be replaced by original parts.

11 - So as to avoid any electro-magnetic perturbation, the equipment must only be used when it is closed. It is also necessary to use shielded cables.

The following symbols are used on FM-MC4 and DFMA02 equipment :

Refer to User's manual.

Protection conductor connection.



Ground position.

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I.GENERAL

I.1.PRODUCT PRESENTATION

The **AUDEMAT-AZTEC FM-MC4 and DFMA02** have been designed for radiobroadcasters who design, install or operate FM transmitters or FM transmitter networks.

Installed within a vehicle, the equipment enables field-strength campaigns to be carried out on several stations of the FM band (87.50-108.00 MHz), while driving, with automatic indexing of each value by a precise geographical location (GPS function available on FM-MC4) and with the best reception frequency selected (RDS function).

Data us acquired via a portable computer.

Powerful and software(MS WINDOWS based) authorises a precise analysis of measurements and multiple geographical representations in colour.

Two Cartographic options enable the campaign results to be transferred onto a map of France (other countries available).

Ahead of campaigns, the "HTZ Lite" cartographic option enables field measurements to be correlated with results issued from simulations of transmitter coverage based on cartography and digital terrain data.

Following campaigns, the "MapInfo" cartographic option enables coverage area restitution and offers full graphic manipulation facilities. This is also a geo-marketing operating tool allowing superimposition of socio-demographic data.

The "AF analysis" data gives an overall view of the main components of the FM modulation base-band signal (MPX, L, R, L+R, L-R, PILOT 19 kHz, RDS 57 kHz, DARC 76KHz or auxiliary frequency between 60 kHz and 90 kHz) thereby enabling optimal adjustment levels.

The "RDS analysis" module enables all the transmitted data to be displayed : PI, PS, AF, EON, ... and error rates of reception to be controlled.

The "DARC analysis" module enables rates of reception errors to be controlled.

The "Scanning" module enables a quick identification of the various programmes broadcast on the local FM band and their main characteristics (level, PI, PS, ...).

AUDEMAT-AZTEC's FM-MC4 and DFMA02 include the most up-to-date technology concerning FM reception, RDS demodulation, DARC demodulation, satellite positioning (GPS) and user-friendly software (WINDOWS 95, 2K and NT).

AUDEMAT-AZTEC's FM-MC4 and DFMA02 have been especially designed to run over hard constraints of an "in-the-car" use (vibrations, temperature, power supply) keeping therefore intact its high performances.

Moreover, all useful subsystems are gathered in the same cabinet which enables a very quick and easy installation and running without any specific preparation or modification to the vehicle.

The equipment and its accessories are easily transportable in a functional bag of reduced size (like hand luggage when travelling by plane).

Their installation within a vehicle, setting them up and operating them only demands a few minutes.

All external connections are located on the front panel of the equipment.

The GPS (FM-MC4) and FM satellite reception antennae are equipped with magnetic bases and cords long enough to be easily connected.

Optionally, the movement sensor may be installed on the FM-MC4 with no intervention on the vehicle (clip system).

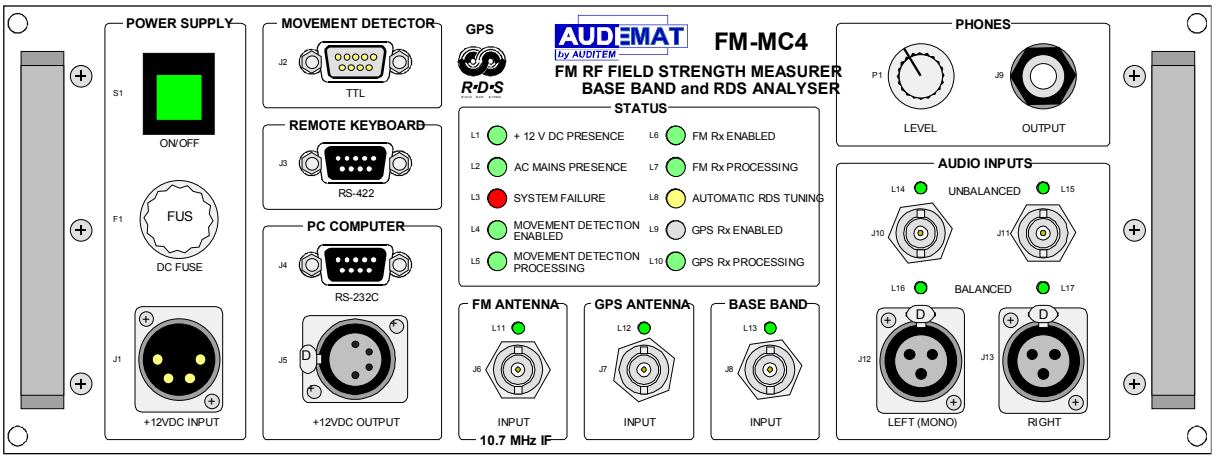
12VDC power is supplied by connection to the vehicle's cigarette lighter.

All connection cables are provided with the equipment.

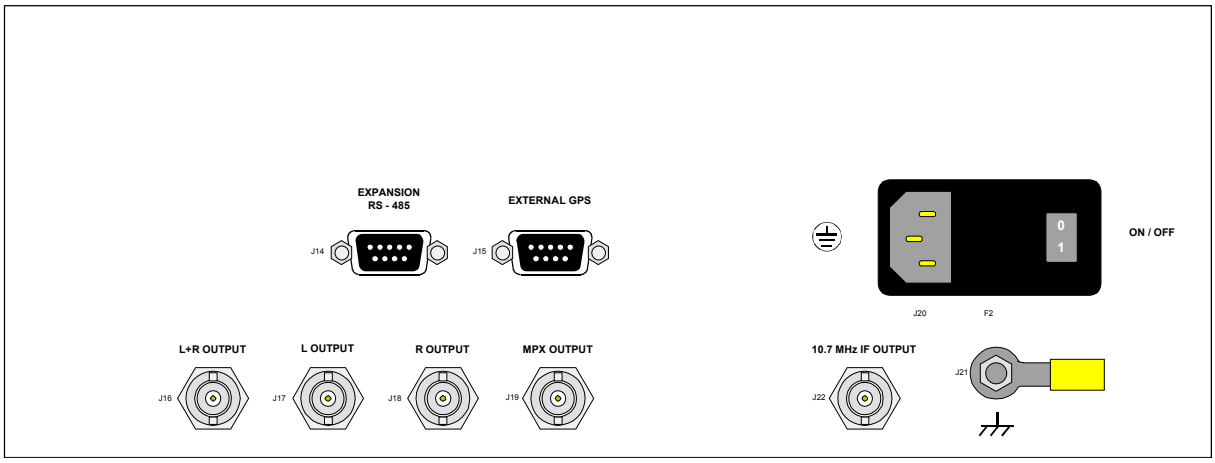
I.2.CONSTITUTION

Details of front and back panels of **AUDEMAT-AZTEC FM-MC4**

FRONT PANEL

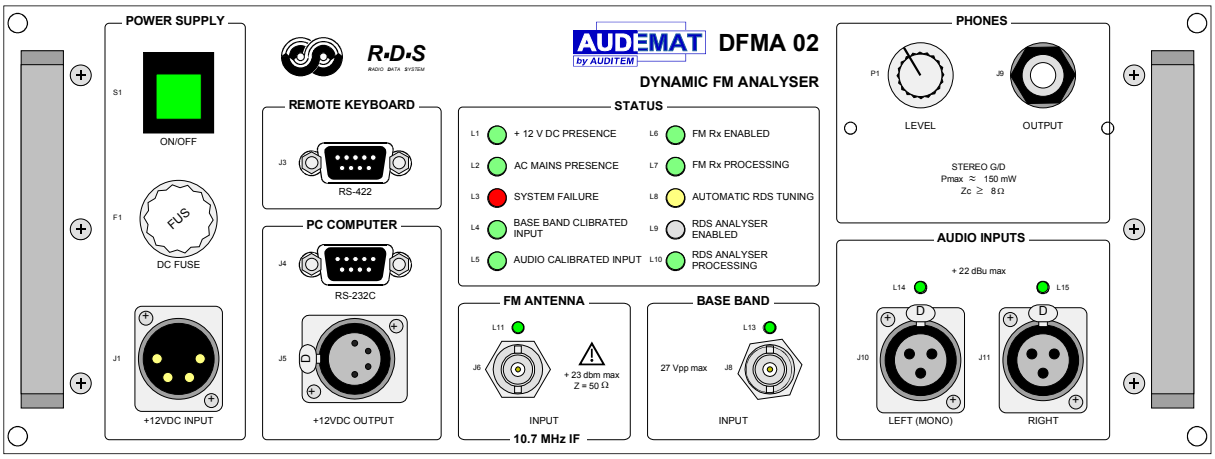


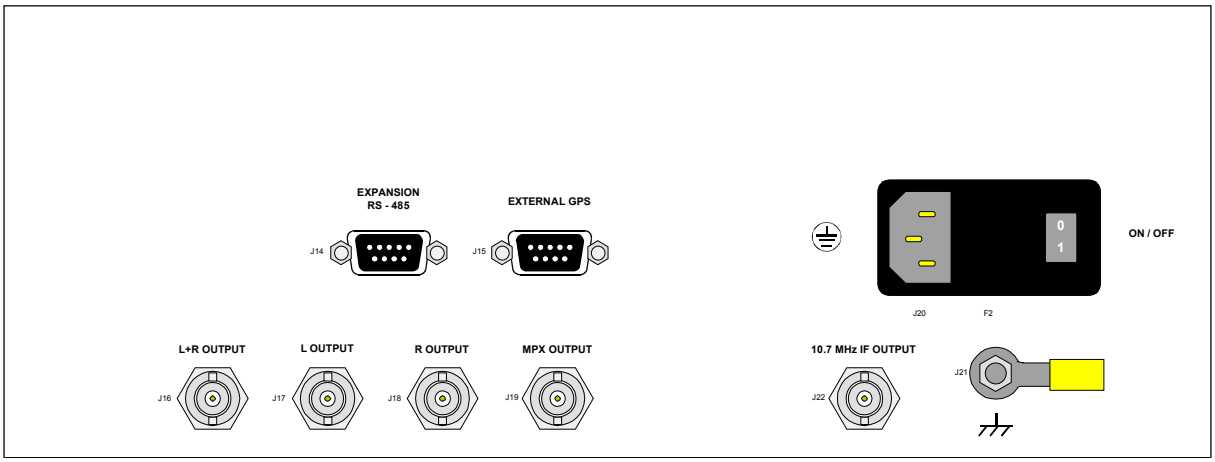
BACK PANEL



Details of front and back panels of **AUDEMAT-AZTEC DFMA02**.

FRONT PANEL





BACK PANEL

The front panel includes, from left to right :

- S1 : ON/OFF equipment switch

- F1 : fuse for external +12V DC power supply

- J1 : external +12V DC power supply input

- J2 : **FM-MC4** : input connector to link movement sensor

- J3 : connector for possible linking to control system (serial link)

- J4 : connector to link computer (serial link)

- J5 : +12V DC power supply output for portable computer

-State display zone :

- L1 : indicates the presence of an external +12V DC power supply

- L2 : indicates the presence of the mains supply

- L3 : indicates a malfunctioning of the equipment

- L4 : **FM-MC4** :indicates the movement sensor's impulses have been taken into account

DFMA02 : indicates that the MPX input calibrated to 8.72Vcc is being used

- L5 : **FM-MC4** : indicates running processing following movement sensor impulses

DFMA02 : indicates that audio input calibrated to +12 dBu is being used

- L6 : indicates the equipment is operational

- L7 : indicates the equipment is carrying out processing

- L8 : indicates RDS retuning is in process

- L9 : **FM-MC4** : indicates the GPS location is valid

DFMA02 : indicates that the '' RDS analysis'' software module is active

- L10 : **FM-MC4** : indicates the GPS is carrying out a location acquisition

DFMA02 : indicates that the ''RDS analysis'' software module is carrying out an analysis

- J6 : input connector to link an FM antenna – 10.7MHz signal input

- J7 : **FM-MC4** : input connector to link a GPS antenna

- J8 : input connector to link a Multiplex signal (for AF monitoring or RDS analysis)

- P1 : adjustment button for headphones output

- J9 : output jack socket for audio headphones

- J10 : **FM-MC4** : input connector to link an unbalanced audio signal, left channel (for AF monitoring)

DFMA02 : input connector to link a balanced signal, left channel (for AF monitoring)

- J11 : **FM-MC4** : input connector to link an unbalanced audio signal, right channel (for AF monitoring)

DFMA02 : input connector to link a balanced audio signal, right channel (for AF monitoring)

- J12 : **FM-MC4** : input connector to link a balanced audio signal, left channel (for AF monitoring)

- J13 : **FM-MC4** : input connector to link a balanced audio signal, right channel (for AF monitoring)

From left to right, the back panel consists of :

- J14 : connector enabling various equipment to be cascaded

- J15 : **FM-MC4** : connector enabling an external GPS to be connected

- J16 : output connector of low impedance Left + Right signal

- J17 : output connector of low impedance Left signal

- J18 : output connector of low impedance Right signal

- J19 : output connector of low impedance internal Multiplex signal

- S2 : mains supply ON/OFF switch

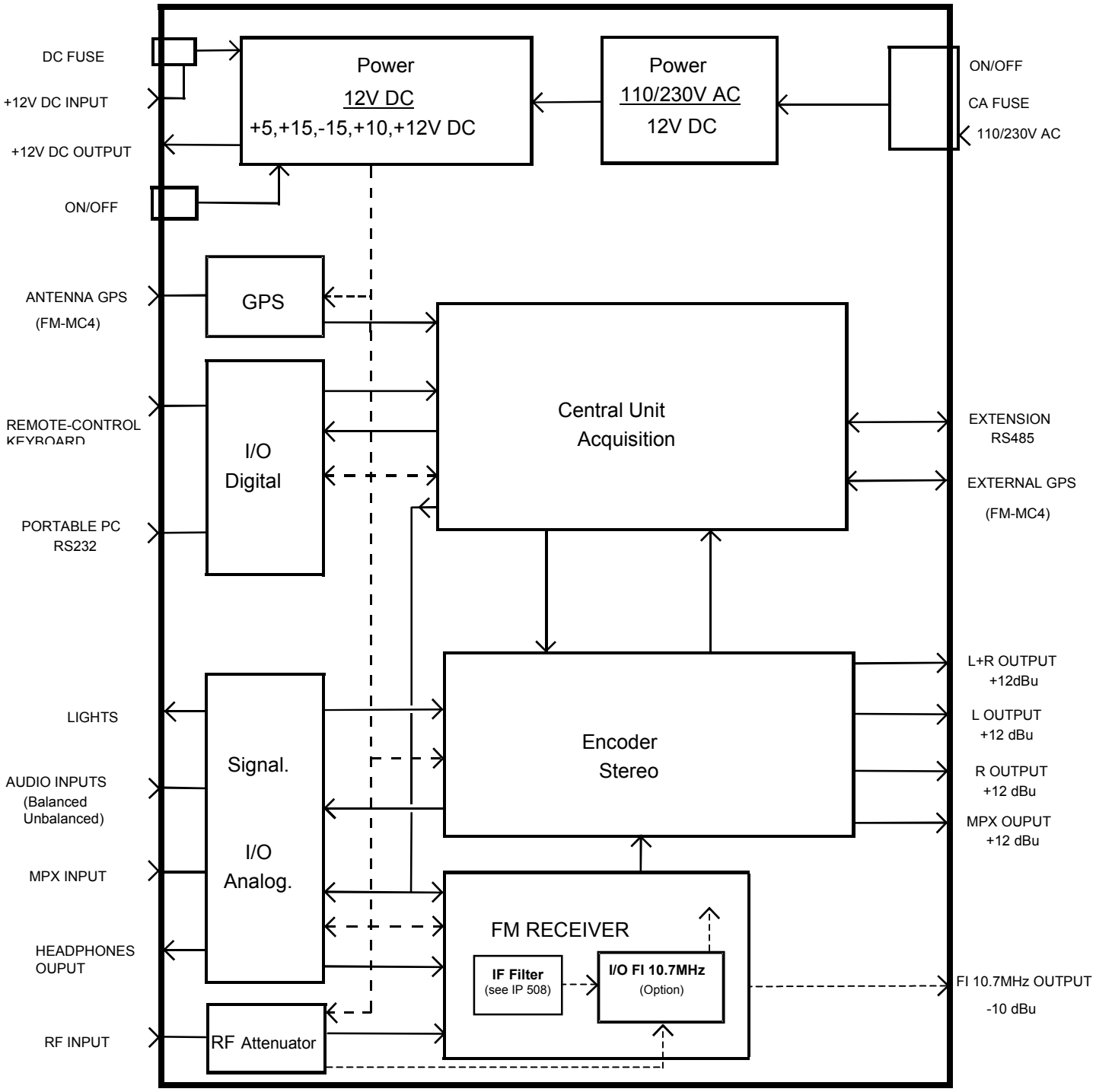
- F2 : mains supply fuse

- J20 : mains supply connector

- J21 : terminal to connect rack to ground

- J22 : **FM-MC4** : FI 10.7MHz (option) output signal

General block diagram of equipment :



I.3.INSTALLATION

I.3.1.Unpacking

Make sure the following equipment and accessories are inside the packing :

- Equipment :

* 1 AUDEMAT-AZTEC FM-MC4 or DFMA02 field-strength measurement equipment.
* 1 strong bag for transport and storage
* 1 mains cable

- Power supply :

* 1 12 VDC power cable (XLR-cigarette lighter plug)
* 1 spare fuse

- reception antennae and cords :

* 1 FM reception antenna, whip type with a magnetic base
* 1 GPS satellite reception antenna with a magnetic base (FM-MC4 only).
* 1 coaxial cable to connect the FM reception antenna
* 1 coaxial cable to connect the GPS satellite reception antenna (FM-MC4 only).

- Movement detector :

* 1 infrared wheel turn detector, equipped with cable ending with a DB9 connector (FM-MC4 only).
* 1 movement detector fixing device (FM-MC4 only).
* white pen (only FM-MC4)

- Computer :

* 1 computer cable RS232C PC port (DB9/DB9)
* 1 4-pin XLR male plug to cable (computer 12 VDC power supply)

-Software :

The following chart indicates software which is available according to delivered equipment .

Standard : software always present in packing on the CD-ROM FM_MC4/DFMA02.
Optional : software delivered following client's request on the CD-ROM RX_DARC.

	EQUIPMENT		
	FM-MC4	**DFMA02**	
SOFTWARE	RXFM_MC4	-	Standard
	MCAF02	DFMA02	
	RX_SCAN	RX_SCAN	
	RX_MCRDS	RX_MCRDS	
	RX_DARC	RX_DARC	optional

- Documentation :

FM-MC4 :

* 1 AUDEMAT-AZTEC FM-MC4/DFMA02 hardware user's manual
* 1 AUDEMAT-AZTEC Field strength measurement (RXFM MC4) software user's manual
* 1 AUDEMAT-AZTEC AF and modulation analysis (MCAF02/DFMA02) software user's manual
* 1 AUDEMAT-AZTEC Scanning (RX_SCAN) software user's manual
* 1 AUDEMAT-AZTEC RDS Annalysis (RX_MCRDS) software user's
* 1 AUDEMAT-AZTEC Darc analysis (RX_DARC) software user's manual (optional).

DFMA02 :

* 1 AUDEMAT-AZTEC FM-MC4/DFMA02 hardware manual
* 1 AUDEMAT-AZTEC AF and modulation analysis (MCAF02/DFMA02) software user's manual
* 1 AUDEMAT-AZTEC Scanning (RX_SCAN) software user's manual
* 1 AUDEMAT-AZTEC RDS Annalysis (RX_MCRDS) software user's manual
* 1 AUDEMAT-AZTEC Darc analysis (RX_DARC) software user's manual (optional).

- PORTABLE COMPUTER

The portable computer necessary to run the system is not included in the initial supply.

For your information, the minimum and the recommended features of the associated portable computer are specified below :

	Windows 9.x	Windows NT 4.x (SP6)	Windows 2k (SP3)
Processor	Pentium 100MHz	Pentium 233MHz	Pentium 300Mhz
RAM memory size	16 Mo	64 Mo	128 Mo
Hard disk size	80 Mo	80 Mo	80 Mo
Centronics printer port	1	1	1
RS232C serial port	1	1	1

AUDITEM can supply, on request, the computer rigorously fitting the system and the software.

I.3.2.Setting up the detectors

Before connecting the equipment, it is necessary to equip the vehicle with various detectors supplied with the system.

- FM reception antenna

The antenna, equipped with a magnetic base, must be fixed on the roof of the vehicle, preferably in the centre so as to avoid modifying the reception diagram.

In other respects, the User will avoid the proximity of other antennae and the presence of interfering metallic elements (roof rack, etc…).

The antenna wire can be installed in such a way as to form a 45° angle with the horizontal, thus presenting an equivalent average sensibility in the H and V polarisation.

- GPS satellite reception antenna (FM-MC4 only).

The antenna, equipped with a magnetic base, must be fixed on the roof of the vehicle.

If its precise location on the roof is not important, the more space there is around the antenna, the better the reception is (GPS satellites are not geo-stationary).

Should there be a roof rack, it would be necessary to install the GPS reception antenna at a higher position, so as its base will be at least at the same level as the highest element of the roof rack.

Note :
In the event of heavy rain, the User should be careful in insulating the exterior connectors, especially the antenna ones (insulating ribbon).

I.3.3.Setting up the movement detector (FM-MC4 only).

The movement detector enables the measurements carried out by the system to be activated. By setting the distance between the two parameter acquisitions (RF field-strength value and/or geographical position by GPS reception), the User may obtain a measurement definition which is more or less precise.

System composition :

The movement detector consists of 2 pre-assembled base elements :

- A movement detector containing an infrared transmitter and a photoelectric receiver in the same box, plus a DB9 connector cable (female, 9 pins).

- A metallic fixing device including : an adjustable jaw to fasten the system to the lower side of the vehicle's rear wing; two articulated and adjustable arms enabling the movement detector to be positioned exactly in front of the wheel; an angle iron supporting the detector. All is delivered pre-assembled.

A white pen for drawing on the tyre is also an accessory supplied with the equipment. A white band ensures the reflection of light on the tyre.

Assembly procedure :

The movement detector must be installed on one of the vehicle's rear wheels, for obvious reasons of stability in relation to the detector (not front wheels).

Taking into consideration the elements of the fixing device and of the vehicle, choose the most appropriate place to clamp it.

Make sure there is enough room between the wing and the wheel, considering the movements due to the flexibility of the shock absorbers and the suspensions (check the inside part of the wing and remove any traces of dry earth or other undesirable element).

Unscrew the bolt fixing the jaws to have enough room to further clamp it on the lower side of the wing . Release the articulations of the arms to make the installation easier.

Once the ideal place to fix the device has been selected, firmly clamp the jaws with the fixing bolt.

Using the articulated arms, place the detector in front of the upper part of the wheel, so that the surface of the detector's active end is parallel to the tyre's lateral surface.

Lightly tighten the articulated arms to ensure a grip which allows further adjusting.

Draw a 3 to 5 cm wide white band on the side of the tyre (avoid grooved or marked areas).

Adjust the position of the detector in front of the white band so as it is centred on the white band at each wheel turn.

Then adjust the distance between the white band surface and the active extremity of the detector to a nominal distance of about 5 cm. In theory, the detector should remain functional for 3 to 10 cm distances, but the meteorological conditions may balance these performances (direct sunlight, projected rain, etc...).

When the position is definitely adjusted, tighten the mobile elements and the articulated arms.

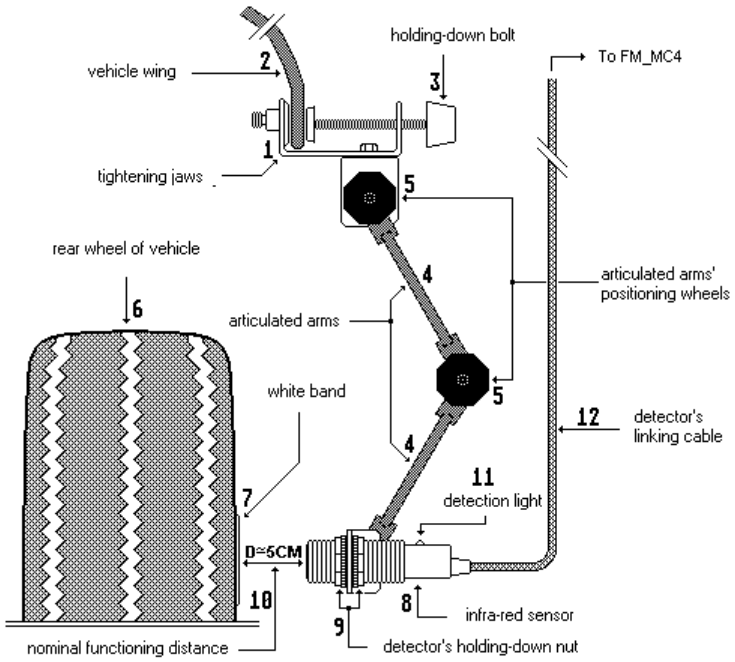
Check the tightening of the jaw supports.
Check the tightening of the support's fixing bolt.
Check the tightening of the detector's fixing screws.
Pass the detector's connection cable inside the vehicle, either under the door if there is enough room (without risking damage to the cable), or through the rear door window.

Connect the cable to the AUDEMAT-AZTEC FM-MC4 equipment, (MOVEMENT DETECTOR connector).

During the calibration of the movement detector, it is possible to control the detector's sensitivity thanks to a red led light on the detector. This lights up when the reflecting surface is being detected and enables the User to control, even adjust, the detector's position or simply to ensure its running.

Caution:
Assembling objects outside a vehicle, which involves the enlargement of the original dimensions of the latter (widthways in particular) is subject to official approval from the Authorities, following installation. We advise the User to comply with this.
AUDITEM will not be responsible for any damages or incidents caused or induced by the system or its installation.

Installation of Movement detector :



I.3.4.Installation of a specific type of movement detector

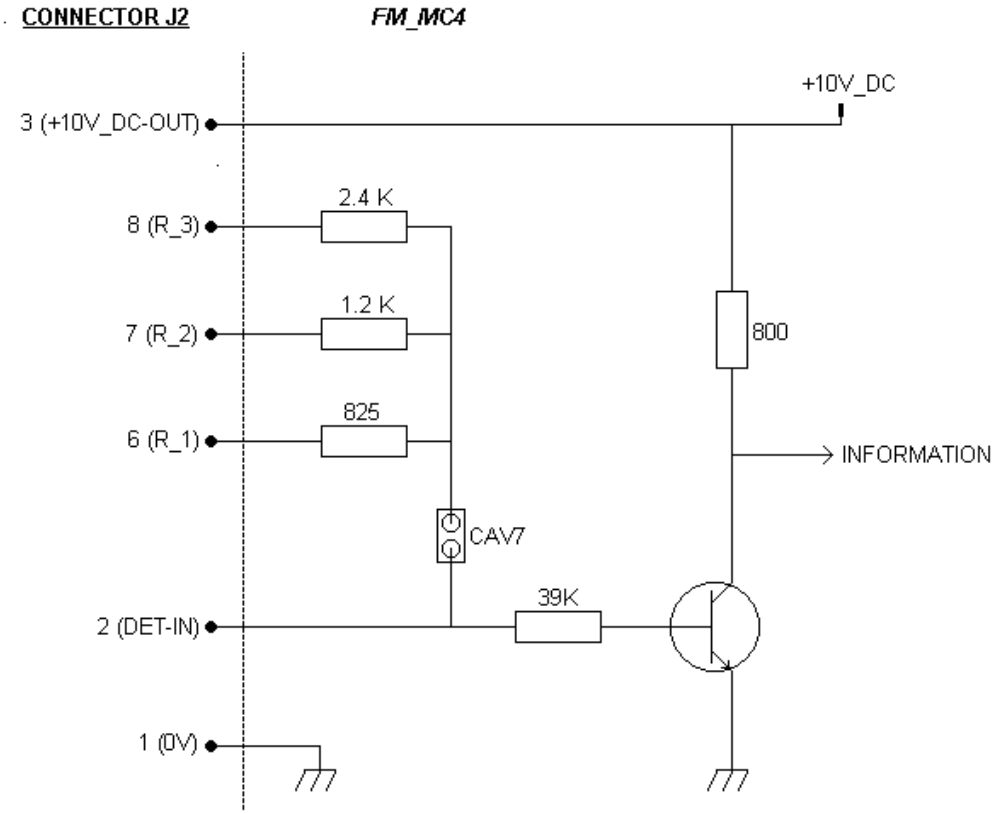
The equipment is configured to operate with the supplied optical detector. However, if the FM-MC4 must be used regularly in the same vehicle it is better to install a permanent detector : it is therefore possible to use, for example, a detector connected to the speed cable (device found on some vehicles) or another system (contact vehicle manufacturer).

Electrical connection :

Various detector technology may be installed to guarantee the compatibility with most systems :

- -relay contact output (referenced to earth)
- -TTL output
- -open collector output (U = 10 V)
  - programmable current : 12 mA, 8 mA and 4 mA

Block diagram of input stage of the movement detector :



The CAV7 jumper enables using a pulling resistor to be validated (grounded or +10V), the used resistor needing to be connected to the 0V signal (1) or +10V_OUT (3) by a strap on the J2 connector.

Sensitivity definition :

Normally, one impulse per wheel turn is transmitted to the PC, if the device installed generates a higher number of impulses per wheel turn, it is possible to divide this number to obtain a correct ratio : the division may be set from 1 to 255.

It is possible to define with jumpers the right division rate to obtain a correct number of impulses per wheel turn. The positioned number must be expressed in binary notation (base 2) ; each jumper corresponds to one bit, the jumpers are marked from CAV9 (low weight) to CAV16 (heavy weight) in other words, eight jumpers (which corresponds to one octet). To obtain a rate of "N", the jumpers must be configured on a number "N-1". For example, to obtain a rate of 10 the number to be configured is 9 i.e. 00001001 in binary notation (CAV9=1, CAV10=0, CAV11=0, CAV12=1, CAV13=0, CAV14=0, CAV15=0, CAV16=0). Caution : "N" is included between 1 and 255, so "N-1" is included between 0 and 254.

Dismantling the equipment :

To modify the position of one or more jumpers, it is necessary to partially dismantle the equipment, according to the following procedure :

Before dismantling the equipment, make sure all connectors are disconnected, above all, the mains plug.

Avoid contact between the circuit pins and any material likely to be carrying electrostatic load.

Do not touch the circuit pins unless you are connected to earth by a conductor strap.

Use a conductor carpet connected to earth when handling sensitive components.

Never plug in or take out subsystems, printed circuits or components when the system is switched on.

CAUTION : Damage to equipment when opening it automatically involves cancelling the guarantee terms.

Tools :

The work-station must be prepared in such a way as to avoid any deterioration to the parts and must present a working area spacious enough to easily handle the equipment's subsystems.
Required tools :

-1 cruciform screwdriver
-1 pliers

Removing the lower cover :

Using a cruciform screwdriver, unscrew and take away the 24 screws maintaining the lower cover. Lift the cover upwards to take it off.

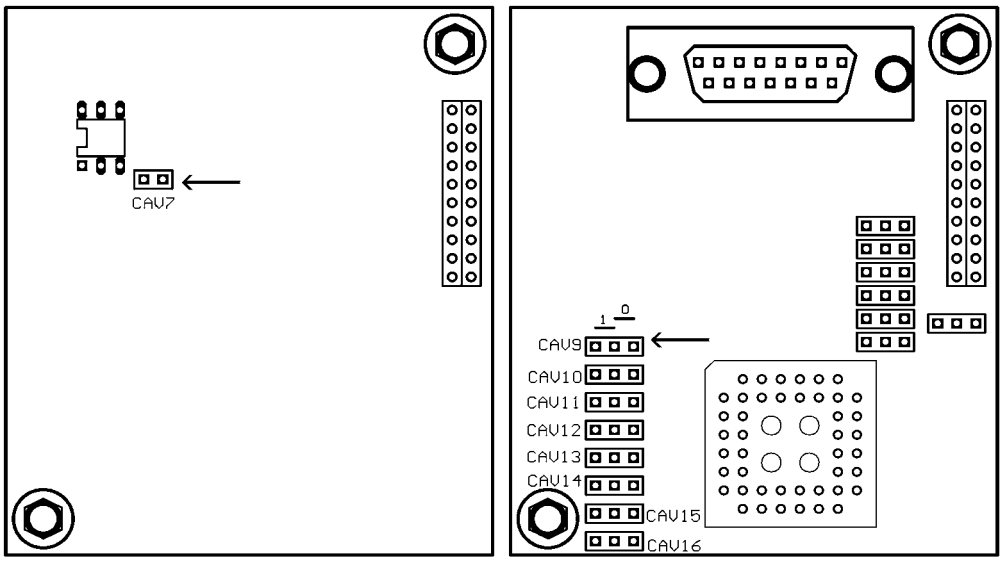
Locating the digital Input/ Output module :

The module with the jumpers to modify is located on the equipment's front panel; it is held on the latter by the three connectors: J2,J3 and J4 ; it consists of two superimposed cards.

Locating and positioning of jumpers :

Jumper CAV7 is found on the card which is fixed directly on the front panel, jumpers CAV9 to CAV 16 are found on the other card ; the following chart indicates clearly the position of each jumper. Pliers are needed to change the jumpers' position.

Set-up diagram of the jumpers :



I.3.5.Connection with an external GPS (FM-MC4 only).

The J15 connector, located on the rear panel of the equipment, enables either to connect an external GPS to the equipment or to output data from the internal GPS.

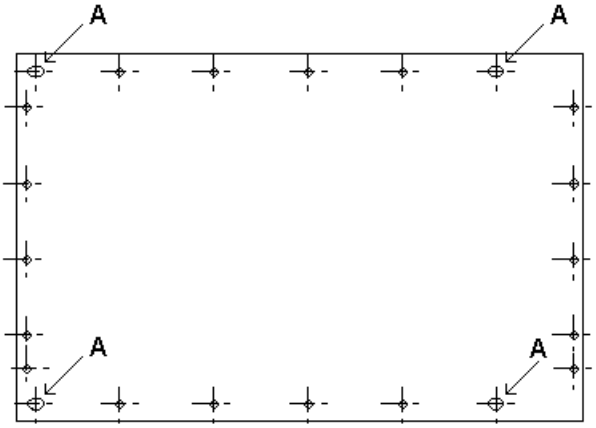
J15 connector's GPS input/ output operating mode selection is carried out by positioning 4 jumpers : CAV9, CAV10, CAV11 and CAV12 located on the digital card referenced : 2484/XX

Access to the digital card is obtained by removing the equipment's upper cover which is also the receiver module's and the digital module's cover.

Dismantling the receiver module :

Using a cruciform screwdriver, unscrew and remove the 4 screws (marked by the letter A on the figure below) which maintain the receiver module. Lift the receiver module upwards to remove it.

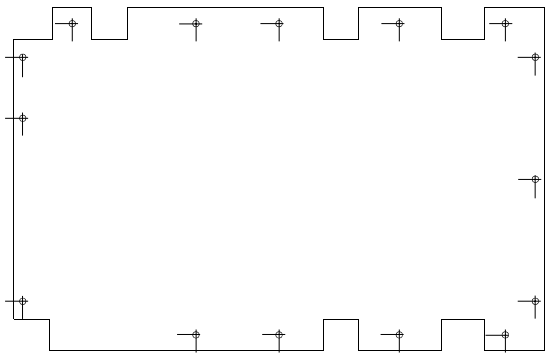
Position of receiver module's fixing holes:



Dismantling the digital module's cover :

Using a cruciform screwdriver, unscrew and remove the 15 screws (marked on the figure below) which maintain the digital module's cover. Lift the cover upwards to remove it.

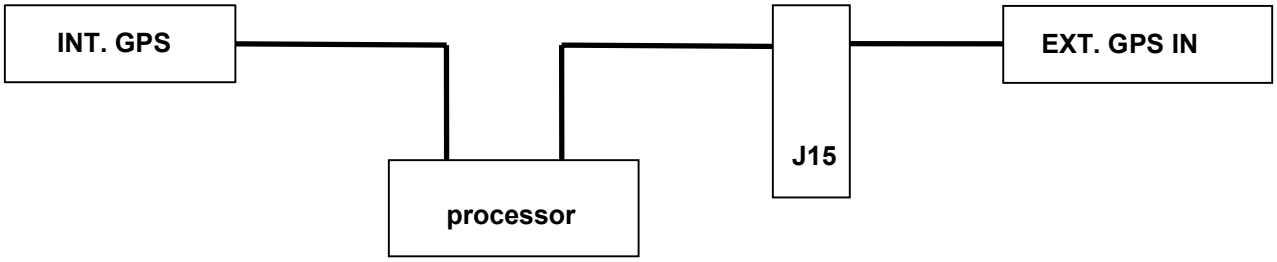
Position of digital module cover's fixing holes :



Operating mode (FM-MC4 only) : (see following diagram)

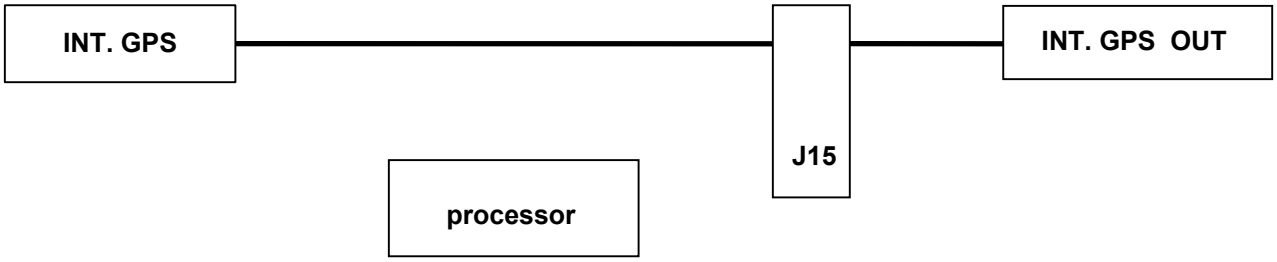
- CAV9, CAV10, CAV11 and CAV12 in position 1-2 : external GPS mode in input ; possibility to connect an external GPS to run a campaign.

Block diagram :



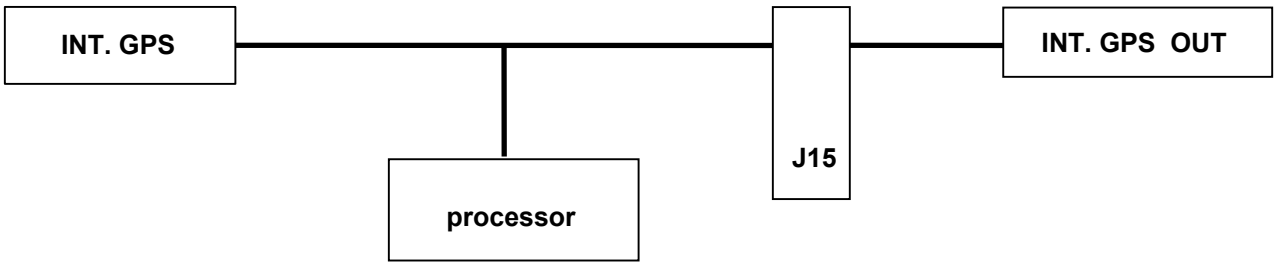
- CAV9, CAV10, CAV11 and CAV12 in position 2-3 : internal GPS mode in output ; internal GPS data are available on the connector output. Internal GPS data are no longer available to carry out a campaign.

Block diagram :

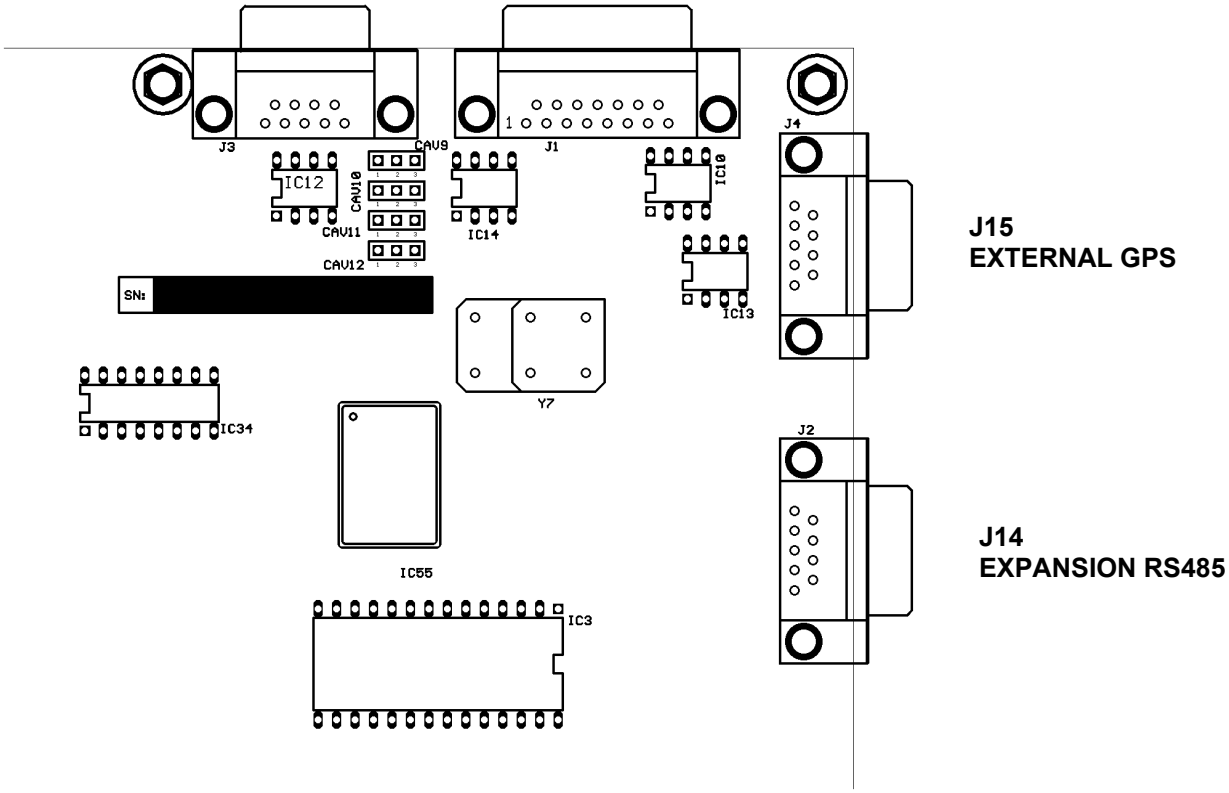


- CAV9 in position 1-2, CAV10, CAV11 and CAV12 in position 2-3 : internal GPS mode in output ; internal GPS data are available on the connector output. Internal GPS data are also available for carrying out a campaign.

Block diagram:



Set-up diagram of the jumpers :



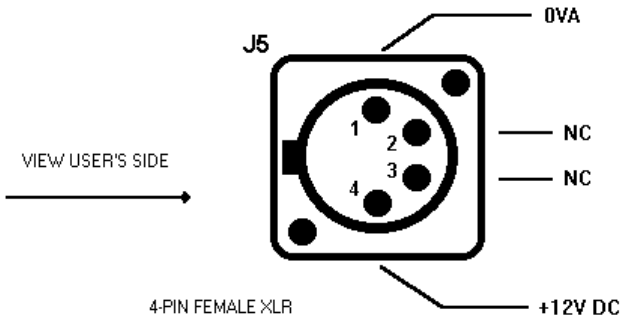
I.3.6.Standard connections of the equipment

The field-strength measuring equipment gathers all the connectors necessary for standard operations on the front panel, thereby greatly simplifying its use within a vehicle and enabling the protection bag to be kept whilst running a measuring campaign.

Connections must be carried out when the equipment and the microcomputer are switched off.

Connections with the portable computer :

- +12 VDC power supply (J5). Using a 12 VDC adapter, usually supplied with the portable computer, cable the 4-pin XLR plug as indicated on the following diagram:



Note : If the vehicle has various +12 VDC supplying sources, the portable computer can be connected directly to one of them.

RS232C serial port.

Using the computer cord SUB-D (9-pin), connect the RS232C communication serial port (COM1 or COM2 where possible) of the portable computer to AUDEMAT-AZTEC's equipment serial port (J4).

Lock the connectors.

Connecting the movement detector (FM-MC4 only).

After correctly fixing the detector to the vehicle's rear wing and after passing the cable under the back door, connect the detector's cable, whose end is a 9-pin female SUB-D 9 plug, to the SUB-D base, (9-pin male) named MOVEMENT DETECTOR (J2).

Lock the connector.

Connection with the FM reception antenna .

Connect the FM reception cable to the BNC connector of the FM antenna input (J6).

Connection with the GPS reception antenna (FM-MC4 only).

Connect the GPS reception cable to the BNC connector of the GPS antenna input (J7).

Connection with the +12 VDC power supply.

Using the supplied 12 VDC power cable (XLR 4-pin female plug – cigarette- lighter male plug) connect the +12 VDC input (J1) of AUDEMAT-AZTEC's equipment to the vehicle's power supply.

Note :

Although the connection to the cigarette-lighter is well adapted to an 'in-the-car' use, this source is fragile (risk of micro-cuts, oxidation, etc...).

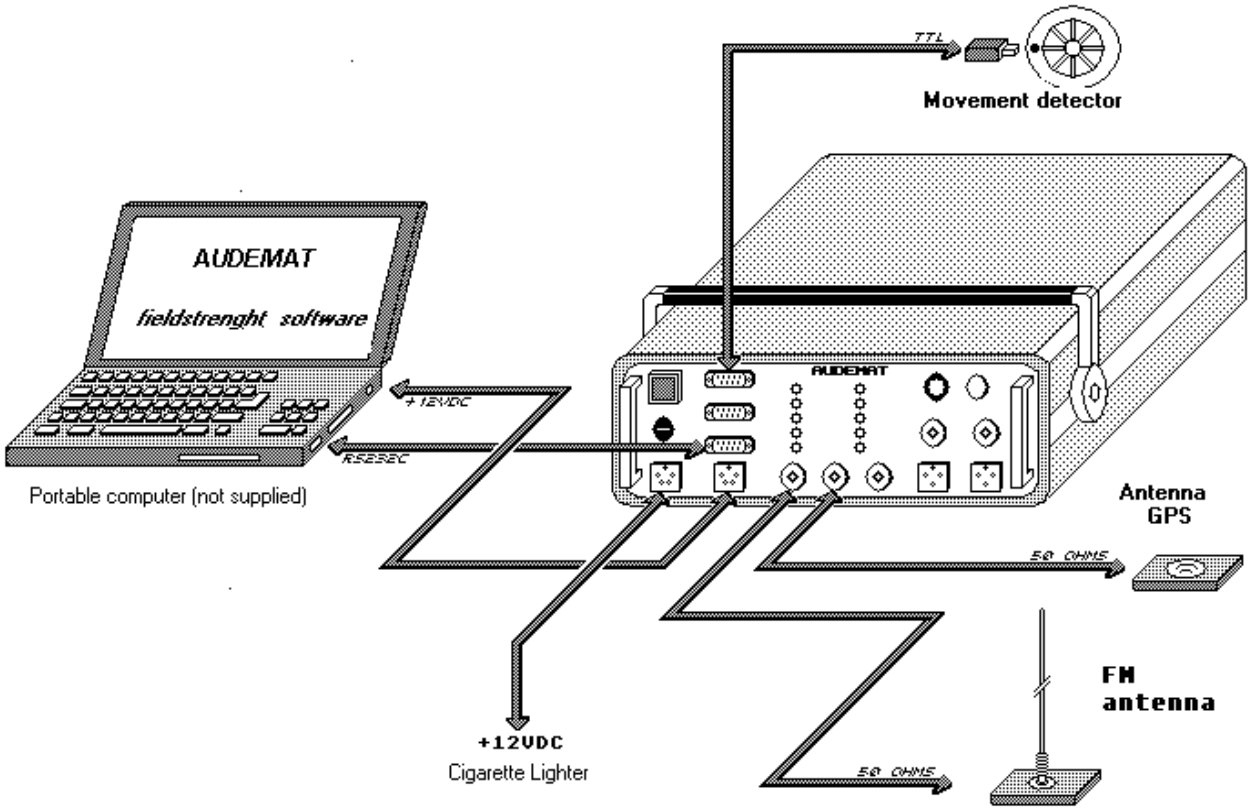
The User should use a safer connecting, if possible, (XLR….) if the vehicle is frequently used for this type of operation.

Connection with control headphones.

This optional connection enables an audio control which is sometimes useful when there is a doubt over the programme identification.

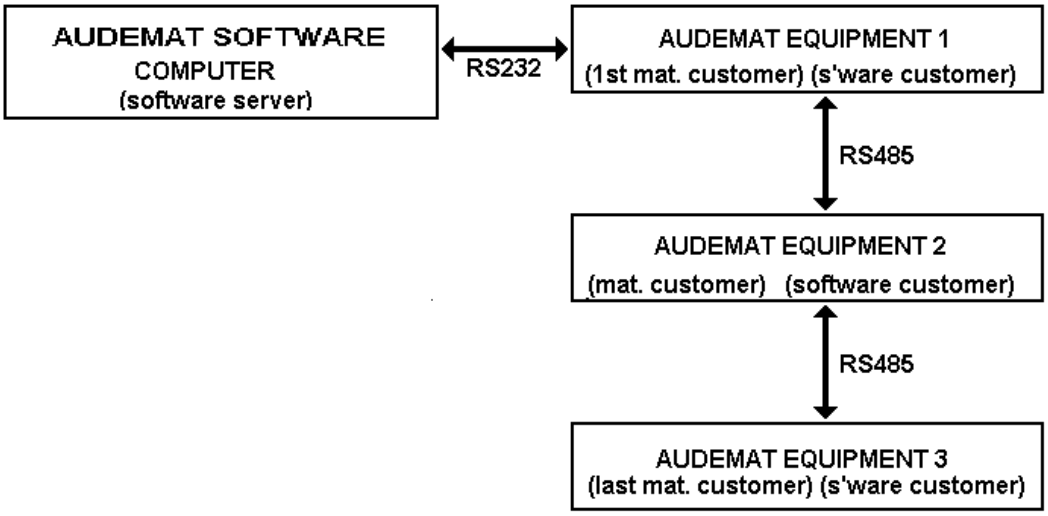
This is a stereo output.

Set-up diagram of general connecting for a campaign (FM-MC4) :



I.3.7.Equipment daisy chaining

Connector J14 (Expansion RS485) located on the rear panel of the equipment enables various AUDEMAT-AZTEC equipment to be daisy-chained in order to link them all onto one serial port of the computer. This enables the PC to communicate with one of several pieces of equipment.



Equipment connected onto the RS232 serial port of the computer is called **first material customer**, the rest of the intermediary equipment connected with the RS485 link is called **material customer**, the equipment at the chain end being named **last material customer**.

The **first material customer** maintains the material interface between the RS232 serial port and the RS485 daisy-chaining port, the intermediary **material customer** is materially transparent and the **last material customer** closes the chain.

The equipment configuration mode selection is carried out by configuring 3 switches : SW15, SW16 and SW17 located on the digital card referenced : 2484/XX.

The switch configuration is done by cutting the path which establishes contact using a sharp blade or by soldering a bridge.

Access to the digital card necessitates lifting off the upper cover which is also the receiver module's and the digital module's cover.

Dismantling the equipment must be done in exactly the same way as that described in the chapter "Connection with an external GPS".

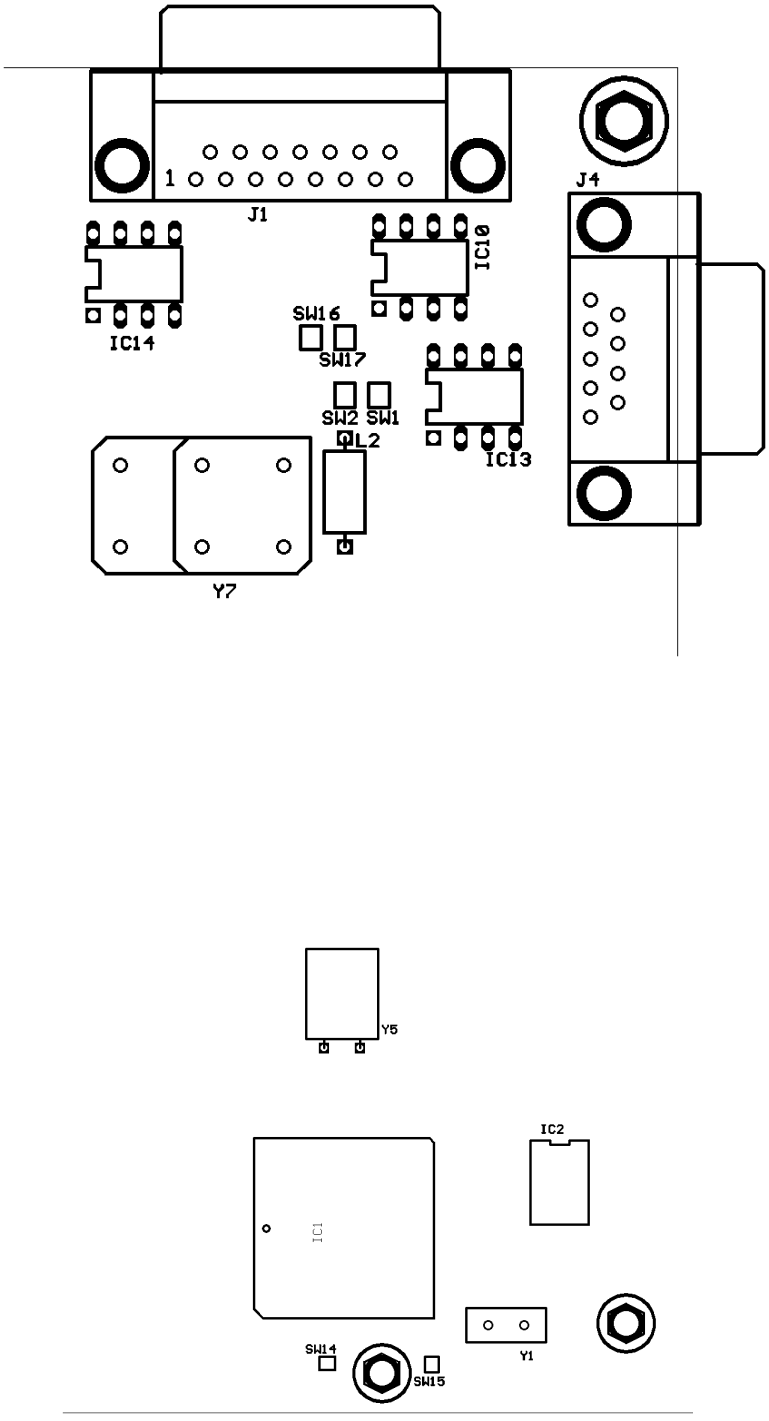
- State of switches SW15, SW16 and SW17 to configure the equipment in **first material client** mode:
SW17 must be disconnected(by default).
SW16 must be connected (by default).
SW15 must be connected (by default).

- State of switches SW15, SW16 and SW17 to configure the equipment in **material customer** mode:
SW15, SW16 and SW17 must be disconnected.

- State of switches SW15, SW16 and SW17 to configure the equipment in **last material customer** mode:
SW17 must be connected.
SW15 and SW16 must be disconnected.

- State of switches SW15, SW16 and SW17 to **disable** the link function :
SW15, SW16 and SW17 must be connected.

Set-up diagram of the switches :



I.3.8.Additional connections of the equipment

The equipment is mainly used to run field-strength measurement campaigns.

It may also be used to carry out RDS or DARC analyses, or AF monitoring. RDS and DARC analyses can be operated on the RF signal or on the base band signal. The AF monitoring can also be carried out on an RF signal or on a base band signal, but working on either a stereo or a mono Audio signal is also possible.

The equipment is also supplied with a remote-controlled stand-by input and an expansion connector ; MPX and audio outputs are available as well.

Base band input :

The base band connector (BNC J8) enables the equipment to be connected to a base band signal. It is then possible to carry out an AF monitoring in order to visualise the main signal components (MPX, Left, Right, Left + Right, Left - Right, Pilot 19 kHz RDS 57 kHz and DARC 76kHz), to carry out an RDS analysis so as to visualise all the broadcast data : PI, PS, AF, EON or even to carry out a DARC analysis ... The signal must be unbalanced and its input level can be configured by software.

Audio input :

Four connectors (two for DFMA02) enable an audio signal to be connected on the equipment to carry out AF monitoring.

On FM-MC4, two types of input are available : unbalanced (connectors BNC J10 and J11) or balanced (connectors XLR J12 and J13).

On DFMA02, only one input type is available : balanced (connectors XLR J10 and J11).

The input level can be configured by software.

Remote-control input :

A remote-control connector is available on the front panel (connector DB9 J3). This connector is has various uses :

- a serial link RS422 is available (pins 1, 2, 3, 4). This link will later add another device to communicate with the equipment.
- 3 TTL input /output are available (pins 6, 7, 8). They will later be used to control or receive information.
- A stand-by control input is available (pin 9). When this pin is off, the equipment is active (normal function). When this pin is connected to earth (pin 5) the equipment is on stand-by : all cards are switched off except power supply modules (+12V DC is always enabled). This system enables the equipment to be switched on/off from a remote place.

Signal FI 10.7MHz input(Option) :

The input connector which connects an FM antenna available on the front panel (BNC J6) enables also an FI 10.7MHz signal to be connected.

Left, Right, Left + Right and MPX signal output :

Four available connectors on the equipment's rear panel (J16, J17, J18 and J19 BNC) recuperate the Left, Right, Left + Right and MPX signals ; these outputs are unbalanced.

FI 10.7MHz signal output (Option) :

An available connector on the equipment's rear panel (J22 BNC) recuperates the FM receiver's FI 10.7MHz signal (FI 10.7MHz Input / Output option).

IMPORTANT :
- Trademarks quoted in this manual are subject to COPYRIGHT and are the property of their respective editors.
- Any reproduction, even partial, of the present manual is forbidden without AUDEMAT-AZTEC's written, prior authorisation.

I.4.STARTING UP

1.4.1.Applying power:

From the mains:

Having connected the equipment to the portable computer (J4) and to the mains (J20), press the AC power supply's main switch (ON/OFF) located on the mains pack of the equipment's rear panel.
The equipment's functional operating is then carried out by pressing the S1 switch located on front panel, after having loosened the security valve. At this stage, the green light located in the centre of S1 comes on.
In order to ensure the equipment's correct starting up, these two operations must be done in the order outlined.
The equipment now carries out a series of internal tests, ending by turning on one signalling light after another to check that they are working.
Once over (this sequence should last a few seconds), the equipment is ready to run.
The L2 light – *mains presence* – stays lit, thus showing the available power type.

From a + 12 VDC external voltage :

Having connected the equipment to the computer (J4) and to an externally protected +12 VDC voltage (typical +13,8 V) via the J1 connector, press the equipment's functional starting up switch (S1) located on the front panel, after having loosened the security valve.
The same testing procedure is now carried out (see above paragraph).
The L1 light - *+ 12 VDC presence* – stays lit, thus showing the available power type.

Note : Should the equipment be connected to the mains and to an external + 12 VDC power source at the same time, and should it be running functionally (AC mains switch and S1 switch both active) L1 - *+ 12 VDC presence* - and L2 – *mains presence* - are lit, thus showing the available power types.
In this case, it is always the mains power which is automatically selected.

CAUTION :
When the equipment has 2 simultaneous power sources (AC and + 12 VDC) :
- + 12 VDC voltage appearance or disappearance is allowed during running, without any risk of blockage or spoiling performances
- the mains voltage appearance or disappearance is not allowed during running, due to the risk of losing data or of blocking the equipment. Should this arise, use a back up type of power source (inverter).

1.4.2.Operating the equipment :

Operating the equipment's functions is detailed within the following software manuals :

* AUDEMAT-AZTEC Field strength measurement (RXFM MC4) software user's manual
* AUDEMAT-AZTEC AF and modulation analysis (MCAF02/DFMA02) software user's manual
* AUDEMAT-AZTEC Scanning (RX_SCAN) software user's manual
* AUDEMAT-AZTEC RDS Annalysis (RX_MCRDS) software user's
* AUDEMAT-AZTEC Darc analysis (RX_DARC) software user's manual (optional).

II.CHARACTERISTICS

II.1.MEASUREMENT AND ANALYSIS CHARACTERISTICS

IF FILTERS

Characteristic, choice and exploitation .....See IP0508-A

MEASURING DYNAMICS :

RF level : ..... -100 to +23 dBm (+7 to +130 dBµV)
MPX level : .....0 to ±150 kHz
Pilot level : .....0 to ±15 kHz
RDS level : .....0 to ±8 kHz
DARC level: .....0 to ±8 kHz
AUX level (60 kHz – 90 kHz) : .....0 to ±8 kHz
AF level L, R, L+R, L-R : ..... -40 to +6dB

MPX POWER :

Sampling frequency : .....256 kHz
Conversion time : ..... 1 µs
Converter resolution : .....14 bits
Measurement resolution : .....9 bits
Level measurement dynamics : .....-150 kHz to +150 kHz
Interval between two level samplings : 600Hz
Elementary cycle duration: .....1 to 60 seconds
Maximum instantaneous measuring cumulation duration : .....1 hour
Maximum power recording duration in slide mode : .....72 hours
Maximum peak recording capacity in one sequence : .....72 hours

PEAK RECORDING :

Recording one path: MPX, Pilot, RDS, DARC or AUX.
Recording two paths: G, D, G+D, G-D.

OTHER FUNCTIONS:

Pilot/RDS synchronisation indicator.
Pilot/DARC synchronisation indicator.
Evaluation of phase between Pilot and RDS sub-carriers: ..... between 0° and 180°
Programmable de-emphasis of L and R paths : .....0, 50µs and 75µs
Programmable pre-emphasis of L and R paths : .....0, 50µs and 75µs

GPS SECTION (FM-MC4) :

Number of satellites : 8
Geographical position : .....±100 m

MOVEMENT DETECTION (FM-MC4) :

Sensor for covered distance : ..... 1-255 impulses/wheel turn

EXACTITUDES :

The exactitudes given below are obtained with the reference signals used at the time of adjusting the equipment :

RF level measurement exactitude : ..... ±2dB (from 30 to 90 dBµV)
MPX level measurement exactitude : ..... ±2.5kHz (to ±75kHz swing)
Pilot level measurement exactitude : ..... ±200Hz (to ±7.1kHz swing)
RDS level measurement exactitude : ..... ±200Hz (to ±4kHz swing)
DARC level measurement exactitude : ..... ±200Hz (to ±4kHz swing)
AUX (60-80kHz) level measurement exactitude : ..... ±200Hz (to ±4kHz swing)
L, R, L + R, L – R level measurement exactitude ..... ±0.2dB (to 0dB WITHOUT pre-emp/de-emp)
MPX power measurement exactitude : ..... ±0.3dB (from -6 to +12dB with ref. IUT 19kHz)

II.2.TECHNICAL CHARACTERISTICS OF RF INPUT

Frequency range : ..... 87.5MHz to 108MHz
Frequency synthesiser step : ..... 10 kHz
Input impedance : ..... 50 ohms
Connector : ..... BNC
Programmable RF attenuator : ..... 0, 20dB and 40dB
Maximum admissible input level : ..... 130dBµV (+23dBm)
Sensitivity for S/B=60dB (RMS 22/22K on MPX) : 40dBµV

II.3.TECHNICAL CHARACTERISTICS OF INPUTS /OUTPUTS

MPX INPUT:

Input impedance : ..... 20 kOhms
Input type : ..... Unbalanced
Connector : ..... BNC
Input level : ..... -18dBu to +18dBu (adjustable by 0.1dB steps)
Maximum admissible input level : ..... +22dBu
Pass-band: ..... 40Hz..100kHz

AF INPUT (L, R):

Impedance : ..... 20 kOhms
Input type : ..... Balanced or unbalanced (FM-MC4)
Balanced input connectors : ..... 3-pin female XLR
Unbalanced input connectors (FM-MC4) : ..... BNC
Input level : ..... -18dBu to +18dBu (adjustable by 0.1dB steps)
Maximum admissible input level : ..... +22dBu
Bandwidth: ..... 40Hz..15kHz

GPS INPUT (FM-MC4) :

Impedance : ..... 50 Ohms
Connector :.....BNC
Central frequency :.....1575.42 MHz

MOVEMENT DETECTION (FM-MC4):

Input type : ..... Current setting (5mA à 15mA) / Tension(+5V à +18V)
Connector :.....9-pin male SUB-D

MPX OUTPUT :

Output impedance :..... < 10 Ohms
Output type :.....Unbalanced
Connector :.....BNC
Nominal output level :..... +12dBu (+8.72V peak-peak for a modulating signal from 500 Hz)
Distortion at +12dBu (1):.....< 0.2% (for a modulating signal to ± 75kHz)

L,R, L+R OUTPUTS :

Output impedance :.....< 10 Ohms
Output type :.....Unbalanced
Connector :.....BNC
Nominal output level :.....+12dBu (+8.72V peak-peak for a modulating signal from 500 Hz in stereo (L=R)

PC CONNECTION :

Connection type : RS232C
Connector :.....9-pin female SUB-D
Communication speed (depending on measurements) :.....9600, 19200 and 115200 bauds

Note : Outputs L, R and MPX are out of phase by 180° in relation to the modulating signal. The L + R output has the modulating signal's polarity.

II.4.MAIN CHARACTERISTICS

Low voltage power supply : .....+ 11 VDC…+ 15 VDC
Consumed energy :.....Around 30 W
Mains power supply ; frequency : .....110 VAC/230 VAC ; 50/60 Hz
Consumed energy (AC) : .....Around 50 VA
Maximum current on +12 VDC output (J5) :.....2A
Input F1 fuse +12VDC :.....F6,3A
Mains supply F2 fuse :.....T2A
Functioning temperature :.....+5°C...+45 °C/ +41°F…+113°F
Dimensions (L x H x D) : ..... 360 x 155 x 405 mm
Weight : .....Around 12 kg

***Note** : The characteristics and performances may be modified by AUDITEM without warning.*
(1) : 0db=0,775V RMS @1 KHz SINUS

III.CABLING THE CONNECTORS

FRONT PANEL MODULE

J1
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Front panel of equipment.

FUNCTION :
External +12VDC power supply voltage input

TYPE :
4-pin male XLR plug

PIN N°	SIGNAL	
	REF.	NATURE
1	0V	Power supply reference 0V input
2	Reserved	Reserved pin
3	Reserved	Reserved pin
4	+12VDC-IN	+12V DC input from external energy source

FRONT PANEL MODULE

J2
CONNECTOR

FM-MC4

LOCATION :
Front panel of equipment.

FONCTION :
Data input – Movement detector.

TYPE :
9-pin male SUBD plug

PIN N°	SIGNAL	
	REF.	NATURE
1	0V	Power supply reference 0V
2	DET-IN	Movement detection signal input
3	+10VDC-OUT	+10V DC output
4	Reserved	Reserved pin
5	Reserved	Reserved pin
6	R_1	825 Ohms pulling resistor
7	R_2	1.21 kOhms pulling resistor
8	R_3	2.43 kOhms pulling resistor
9	Reserved	Reserved pin

FRONT PANEL MODULE

J3
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Front panel of equipment.

FUNCTION :
Data input / output – Format RS422 – Optional keyboard.

TYPE :
SUBD 9- pin female plug

PIN N°	SIGNAL	
	REF.	NATURE
1	REM_RX+	RS422 – remote-control reception signal - Positive
2	REM_RX-	RS422 – remote-control reception signal - Negative
3	REM_TX-	RS422 – remote-control transmission signal - Negative
4	REM_TX+	RS422 - remote-control transmission signal - Positive
5	0V	Power supply referenced 0V
6	IO3	Reserved TTL input / output
7	IO2	Reserved TTL input / output
8	IO1	Reserved TTL input / output
9	AL_ONOF	On / Standby control

FRONT PANEL MODULE

J4
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Front panel of equipment.

FUNCTION :
Data input / output - Format RS232C.

TYPE :
SUBD 9- pin female plug

PIN N°	SIGNAL	
	REF.	NATURE
1	TX+	RS422 – PC transmission signal - Positive
2	TXD_TX-	RS422 - PC transmission signal - RS232C transmission to PC-signal
3	RXD_RX-	RS422 - PC reception signal - negative - RS232C PC reception signal
4	RX+	RS422 - PC reception signal - positive
5	0V	Power supply referenced 0V
6	Reserved	Reserved pin
7	Reserved	Reserved pin
8	Reserved	Reserved pin
9	RI	Buzzer detection signal

FRONT PANEL MODULE

J5
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Front panel of equipment

FUNCTION :
+12VDC power supply output.

TYPE :
XLR 4- pin female plug

PIN N°	SIGNAL	
	REF.	NATURE
1	0V	Power supply referenced 0V outlet
2	Reserved	Reserved pin
3	Reserved	Reserved pin
4	+12VDC-OUT	+12V DC output

FRONT PANEL MODULE

J6
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Front panel of equipment.

FUNCTION :
Reception antenna RF signal input.

TYPE :
BNC female plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	RF_RX_IN	RF signal input – RECEIVER
2	0V	Power supply referenced 0V

FRONT PANEL MODULE

J7
CONNECTOR

FM-MC4

LOCATION :
Front panel of equipment.

FUNCTION :
GPS antenna RF signal input.

TYPE :
BNC female plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	RF_GPS_IN	RF signal input - GPS
2	0V	Power supply referenced 0V

FRONT PANEL MODULE

J8
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Front panel of equipment.

FUNCTION :
External Multiplex signal input.

TYPE :
Female BNC plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	MPX_IN	External Multiplex signal input
2	0V	Power supply referenced 0V

FRONT PANEL MODULE

J9
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Front panel of equipment.

FUNCTION :
Amplified stereo modulation output for headphones.

TYPE :
Amplified stereo jack socket, 6,35 mm, for headphones.

PIN N°	SIGNAL	
	REF.	NATURE
1	0V	Power supply referenced 0V
Middle	PHONE/L-OUT	Left AF signal output for headphones
Extremity	PHONE/R-OUT	Right AF signal output for headphones

FRONT PANEL MODULE

J10
CONNECTOR

FM-MC4

LOCATION :
Front panel of equipment

FUNCTION :
Unbalanced AF input, Left channel.

TYPE :
Female BNC plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	AFG_EXT	Unbalanced AF input, Left channel
2	0V	Power supply referenced 0V

FRONT PANEL MODULE

J10
CONNECTOR

DFMA02

LOCATION :
Front panel of equipment

FUNCTION :
Balanced AF input, Left channel.

TYPE :
3-pin female XLR plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	AFG_EXT_0V	Balanced AF input - 0V
2	AFG_EXT_+	Balanced AF input - Positive
3	AFG_EXT_-	Balanced AF input - Negative
4	AFG_EXT_M	Balanced AF input - Earth

FRONT PANEL MODULE

J11
CONNECTOR

FM-MC4

LOCATION :
Front panel of equipment.

FUNCTION :
Unbalanced AF input, Right channel.

TYPE :
Female BNC plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	AFD_EXT	Unbalanced AF input, Right channel.
2	0V	Power supply referenced 0V

FRONT PANEL MODULE

J11
CONNECTOR

DFMA02

LOCATION :
Front panel of equipment

FUNCTION :
Balanced AF input, Right channel.

TYPE :
3-pin female XLR plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	AFD_EXT_0V	Balanced AF input - 0V
2	AFD_EXT_+	Balanced AF input – Positive
3	AFD_EXT_-	Balanced AF input – Negative
4	AFD_EXT_M	Balanced AF input - Earth

FRONT PANEL MODULE

J12
CONNECTOR

FM-MC4

LOCATION :
Front panel of equipment

FUNCTION :
Balanced AF input, Left channel.

TYPE :
3-pin female XLR plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	AFG_EXT_0V	Balanced AF input - 0V
2	AFG_EXT_+	Balanced AF input - Positive
3	AFG_EXT_-	Balanced AF input - Negative
4	AFG_EXT_M	Balanced AF input – Earth

FRONT PANEL MODULE

J13
CONNECTOR

FM-MC4

LOCATION :
Front panel of equipment

FUNCTION :
Balanced AF input, Right channel.

TYPE :
3-pin female XLR plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	AFD_EXT_0V	Balanced AF input - 0V
2	AFD_EXT_+	Balanced AF input – Positive
3	AFD_EXT_-	Balanced AF input – Negative
4	AFD_EXT_M	Balanced AF input – Earth

BACK PANEL MODULE

J14
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Back panel of equipment.

FUNCTION :
Input / Output for supplementary or optional equipment - Format RS485.

TYPE :
SUBD 9-pin female plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	RS485_A	RS485 Bus - A line
2	Reserved	Reserved pin
3	EN_TX	RS485-transmission validation input
4	DIS_RX	RS485-reception disabling input
5	Reserved	Reserved pin
6	RS_485B	RS485 bus – B line
7	0V	Power supply referenced 0V
8	Reserved	Reserved pin
9	Reserved	Reserved pin

BACK PANEL MODULE

J15
CONNECTOR

FM-MC4

LOCATION :
Back panel of equipment.

FUNCTION :
Data Input / Output - External GPS - Format RS422.

TYPE :
SUBD female 9-pin plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	GPS_RX+	RS422 – External GPS control reception signal – Positive
2	GPS_RX-	RS422 – External GPS control reception signal – Negative
3	GPS_TX-	RS422 – External GPS control transmission signal – Negative
4	GPS_TX+	RS422 – External GPS control transmission signal – Positive
5	0V	Power supply referenced 0V
6	Reserved	Reserved pin
7	Reserved	Reserved pin
8	Reserved	Reserved pin
9	Reserved	Reserved pin

BACK PANEL MODULE

J16
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Back panel of equipment.

FUNCTION :
Left + Right channel signal output - Low impedance.

TYPE :
BNC female plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	L+R_OUT	Left + Right channel signal output - Low impedance
2	0V	Power supply referenced 0V

BACK PANEL MODULE

J17
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Back panel of equipment.

FUNCTION :
Left channel signal output - Low impedance.

TYPE :
BNC female plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	L_OUT	Left channel signal output – Low impedance
2	0V	Power supply referenced 0V

BACK PANEL MODULE

J18
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Back panel of equipment.

FUNCTION :
Right channel signal output - Low impedance.

TYPE :
BNC female plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	R_OUT	Right channel signal output - Low impedance
2	0V	Power supply referenced 0V

BACK PANEL MODULE

J19
CONNECTOR

FM-MC4 - DFMA02

LOCATION :
Back panel of equipment.

FUNCTION :
Multiplex signal output - Low impedance.

TYPE :
BNC female plug.

PIN N°	SIGNAL	
	REF.	NATURE
1	MPX_OUT	Multiplex signal output - Low impedance
2	0V	Power supply referenced 0V

BACK PANEL MODULE

J22
CONNECTOR

FM-MC4

LOCATION :
Back panel of equipment.

FUNCTION :
FM receiver FI 10.7MHz signal output.

TYPE :
BNC female bulkhead adapter .

PIN N°	SIGNAL	
	REF.	NATURE
1	FI_OUT	FI 10.7MHz signal output
2	0V	Power supply referenced 0V

APPENDIX A : SECURITY STANDARDS.

FM_MC4 and DFMA02 have been built and checked according to the following security standards :

EN 50081 - 1	:	Electro-magnetic compatibility : general transmission standard (Residential, commercial et light industry).
EN 50082 - 1	:	Electro-magnetic compatibility : general immunity standard (Residential, commercial et light industry).
EN 55022	:	Limits and measuring methods of features of radio-electric interference produced by information processing apparatus.
EN 61000 - 3 - 2	:	Electro-magnetic compatibility : limits for harmonic current transmissions (CEI 1000-3-2).
EN 61010 - 1	:	Security regulations for electrical measuring, adjusting and laboratory apparatus.
EN 60215	:	Security regulations applicable to radio-electrical transmission material.

Otherwise conform to TDF specification **SN 97002 version 1.0**.